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NOTIFICATION OF TRANSMITTAL OF  
THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT

(PCT Rule 71.1)

<b>To:</b>  HILL, Donald M., Jr. ALSTON & BIRD LLP Bank of America Plaza 101 South Tryon Street, Suite 4000 Charlotte, NC 28280-4000 ETATS-UNIS D'AMERIQUE		Date of mailing (day/month/year)      22.08.2005
Applicant's or agent's file reference 38569/268117		<b>IMPORTANT NOTIFICATION</b>
International application No. PCTUS 03/25029	International filing date (day/month/year) 08.08.2003	Priority date (day/month/year) 08.08.2003
Applicant HONEYWELL INTERNATIONAL INC. et al.		

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary examination report and its annexes, if any, established on the international application.
2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.
3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.



**4. REMINDER**

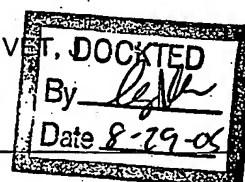
The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary examination report. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.



The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer GEISWILLER-BOUVIER Tel. +49 89 2399-5895	
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## PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT  
(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 38569/268117	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEAA16)	
International application No. PCT/US 03/25029	International filing date (day/month/year) 08.08.2003	Priority date (day/month/year) 08.08.2003
International Patent Classification (IPC) or both national classification and IPC F02B37/12		
Applicant HONEYWELL INTERNATIONAL INC. et al.		
<p>1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p><input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).</p> <p>These annexes consist of a total of 5 sheets.</p>		
<p>3. This report contains indications relating to the following items:</p> <p>I <input checked="" type="checkbox"/> Basis of the opinion</p> <p>II <input type="checkbox"/> Priority</p> <p>III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p>IV <input type="checkbox"/> Lack of unity of invention</p> <p>V <input checked="" type="checkbox"/> Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p>VI <input type="checkbox"/> Certain documents cited</p> <p>VII <input type="checkbox"/> Certain defects in the international application</p> <p>VIII <input type="checkbox"/> Certain observations on the international application</p>		
Date of submission of the demand  22.09.2004	Date of completion of this report  22.08.2005	
Name and mailing address of the international preliminary examining authority:   European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer  Pileri, P  Telephone No. +49 89 2399-7907  	

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/US 03/25029**

**10/566491**

**IAP20 Rec'd PCT/PTO 30 JAN 2006**

**I. Basis of the report**

1. With regard to the elements of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17):*

**Description, Pages**

1-10 as originally filed

**Claims, Numbers**

1-19 received on 22.06.2005 with letter of 22.06.2005

**Drawings, Sheets**

1/10-10/10 as originally filed

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).  
☐ the language of publication of the international application (under Rule 48.3(b)).  
☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.  
☐ filed together with the international application in computer readable form.  
☐ furnished subsequently to this Authority in written form.  
☐ furnished subsequently to this Authority in computer readable form.  
☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.  
☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:  
☐ the claims, Nos.:  
☐ the drawings, sheets:

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT**

International application No. **PCT/US 03/25029**

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

*(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)*

6. Additional observations, if necessary:

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement**

Novelty (N)	Yes: Claims	1-19
	No: Claims	
Inventive step (IS)	Yes: Claims	1-19
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-19
	No: Claims	

**2. Citations and explanations**

**see separate sheet**

**INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/US 03/25029

**IAP20 Rec'd PCT/PTO 30 JAN 2006****Re Item V****Reasoned statement with regard to novelty, inventive step or industrial applicability;  
citations and explanations supporting such statement****1 Reference is made to the following documents:**

- D1: PATENT ABSTRACTS OF JAPAN vol. 2002, no. 04, 4 August 2002 (2002-08-04) & JP 2001 355453 A (TAKEMOTO SHIGETO), 26 December 2001 (2001-12-26)
- D2: GB-A-2 244 312 (MOTOREN TURBINEN UNION) 27 November 1991 (1991-11-27)
- D3: GB-A-2 163 483 (SOLEX) 26 February 1986 (1986-02-26)

**2 The document D3, which is regarded as being an important document, shows a system for supplying compressed air to a combustion engine whereby a recirculation line is arranged to recirculate a portion of the compressed air to the compressor air inlet. A bypass control valve is provided in the recirculation passage to control flow through the recirculation passage.**

The subject-matter of claims 1 and 16 differs from this known prior art in that the recirculation valve is open when the engine is operating below a threshold engine speed and closed when the engine is operating above said threshold engine speed.

The subject matter of claims 1 and 16 is new in sens of Article 33(2) PCT.

In D3 the recirculation valve is controlled so that the pressure would be high when the engine load demand is high and would be low when the engine load is light. The recirculation valve is therefore closed when the engine load demand is high and open when the engine load is light.

In D1, which is also considered an important document, the recirculation valve is open when the compressor discharge pressure is above a predetermined threshold, this occurs however regardless of speed.

**3 The object of the present invention is to avoid compressor surge.**

The solution proposed in claims 1 and 16 of the present application involves an inventive step. The control of the recirculation valve as described in the claims is in fact neither described nor suggested by the documents cited in the search report.

- 4** The invention is industrial applicable.

IAP20 Rec'd PCT/PTO 30 JAN 2006

THAT WHICH IS CLAIMED:

1. A system (10) for supplying compressed air to an internal combustion engine (14) so as to boost power output by the engine, said system comprising:

a compressor (11) having a rotary compression device (30) positioned in a housing (24) defining an air inlet (23) and a compressed air outlet (32), wherein the air inlet (23) is configured to supply inlet air to the rotary compression device, wherein the rotary compression device is configured to compress the inlet air and wherein the compressed air outlet is configured to allow the compressed air to exit the housing for supply to an intake of the engine;

a recirculation line (18) arranged to recirculate a portion of the compressed air discharged from the compressed air outlet (32) back to the compressor air inlet (23);

a recirculation valve (22) disposed in the recirculation line (18) and operable to control rate of flow through the recirculation line, the recirculation valve being controllable via control signals;

a programmed controller (21) in communication with the recirculation valve (22) and programmed to send control signals to the recirculation valve to open the recirculation valve so as to recirculate compressed air through the recirculation line (18) to the compressor air inlet (23) when the engine is operating below a threshold engine speed, and to maintain the recirculation valve closed so as to prevent recirculation when the engine is operating above said threshold engine speed; and

an air cooling device (50) connected in fluid communication with the recirculation line (18) and operable to cool the recirculated air upstream of the compressor air inlet (23), wherein the cooled air from the recirculation line is combined with the inlet air upstream of the compressor air inlet, the cooled recirculated air reducing occurrence of compressor surge.

2. The system of Claim 1, wherein the controller (21) is programmed to control an amount of the valve opening (RVO) of the recirculation valve (22) as a function of the engine speed and the outlet air pressure.

3. The system of Claim 2, wherein the controller (21) is programmed to control the amount of valve opening (RVO) according to the equation:

$$RVO = A/N_e + B/P_{2C}$$

wherein A and B are predetermined constants,  $N_e$  is the engine speed and  $P_{2C}$  is the outlet air pressure.

4. The system of Claim 1, further comprising a compressor discharge line (13) connecting the engine intake and the compressor outlet (32), wherein a first end (27) of the recirculation line (18) is connected to the compressor discharge line (13) and wherein the air cooling device (50) is connected in fluid communication with the compressor discharge line (13) upstream of the recirculation line (18) first end and compressor discharge line (13) connection.

5. The system of Claim 1, further comprising a compressor inlet line (12) connected to the compressor air inlet (23), wherein a second end (28) of the recirculation line (18) is connected to the compressor inlet line (12).

6. The system of Claim 5, further comprising a mixing device (20) connected to the recirculation line (18) and the compressor inlet line (12) and operable for mixing cooled, recirculated air from the recirculation line with inlet air from the compressor inlet line.

7. The system of Claim 6, wherein the mixing device (20) is an air cleaner.

8. The system of Claim 6, further comprising an air cleaner (49) connected to the compressor inlet line (12) upstream of the mixing device (20).

9. The system of Claim 1, further comprising a compressor discharge line (13) connecting the engine intake and the compressor outlet (32), wherein a

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first end (27) of the recirculation line (18) is connected to the compressor discharge line (13) and a second end (28) of the recirculation line is in fluid communication with the compressor air inlet (23), and wherein the air cooling device (50) is disposed between the first end (27) and the second end (28) of the recirculation line (18).

10. The system of Claim 1, further comprising a compressor inlet line (12) connected to the compressor air inlet (23), the recirculation line (18) being connected to the compressor inlet line (12), and further comprising an air cleaner (49) connected to the compressor inlet line (12) downstream of the recirculation line (18) and compressor inlet line (12) connection, and wherein the air cleaner (49) is also configured to mix recirculated and inlet air.

11. The system of Claim 10, further comprising a compressor discharge line (13) connecting the engine intake and the compressor outlet (32), wherein the recirculation line (18) is connected to the compressor discharge line (13).

12. The system of Claim 11, further comprising a second air cooler (19) connected in fluid communication with the compressor discharge line (13) downstream of the recirculation line (18) and compressor discharge line (13) connection.

13. The system of Claim 11, further comprising an exhaust gas recirculation line (17) connected to the compressor discharge line (13) downstream of the connection between the recirculation line (18) and compressor discharge line (13).

14. The system of Claim 13, further comprising an exhaust gas cooling device (42) connected to the exhaust gas recirculation line (17).

15. The system of Claim 14, further comprising a second air cooling device (19) connected to the compressor discharge line (13) downstream of the recirculation line (18) first end (27) and compressor discharge line (13) connection.

and upstream of the exhaust gas recirculation line (17) and compressor discharge line (13) connection.

16. A method of actively controlling compressor surge in an engine system wherein air is compressed in a compressor (11) and supplied to an intake of an internal combustion engine (14), said surge controlling method comprising the steps of:

- supplying air to a compressor inlet (23) of the compressor (11);
- compressing the air in the compressor;
- discharging the compressed air from the compressor through a compressor discharge line (13) to the intake of the internal combustion engine (14);

- providing a recirculation line (18) connecting the compressor discharge line (13) to the compressor inlet (23);

- providing a controllable recirculation valve (22) in the recirculation line (18) for controlling an amount of flow through the recirculation line;

- opening the valve (22) and recirculating compressed air from the compressor discharge line (13) to the compressor inlet (23) when the engine (14) is operating below a threshold engine speed, and maintaining the valve (22) closed so as to prevent recirculation when the engine (14) is operating above said threshold engine speed; and

- cooling the recirculated air prior to delivering the recirculated air to the compressor inlet (23).

17. The method of Claim 16, further comprising mixing the cooled recirculated air with the air being supplied to the compressor inlet (23) such that flow conditions entering the compressor (11) are more uniform than would exist without said mixing.

18. The method of Claim 16, wherein an amount of the valve opening (RVO) of the recirculation valve (22) is a function of the engine speed and the outlet air pressure of the compressed air discharged from the compressor (11).

19. The method of Claim 18, wherein the amount of valve opening (RVO) is controlled according to the equation:

$$RVO = A/N_e + B/P_{2C}$$

wherein A and B are predetermined constants,  $N_e$  is the engine speed and  $P_{2C}$  is the outlet air pressure.

**Box No. V**      **DESIGNATION OF STATES** *Mark the applicable check-boxes below; at least one must be marked.*

The following designations are hereby made under Rule 4.9(a):

**Regional Patent**

- ☒ **AP**      **ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, MZ Mozambique, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZM Zambia, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT (if other kind of protection or treatment desired, specify on dotted line).....
- ☒ **EA**      **Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP**      **European Patent:** AT Austria, BE Belgium, BG Bulgaria, CH & LI Switzerland and Liechtenstein, CY Cyprus, CZ Czech Republic, DE Germany, DK Denmark, EE Estonia, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, HU Hungary, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, RO Romania, SE Sweden, SI Slovenia, SK Slovak Republic, TR Turkey, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA**      **OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GQ Equatorial Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line).....

**National Patent** (if other kind of protection or treatment desired, specify on dotted line):

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| <input checked="" type="checkbox"/> <b>AG</b> Antigua and Barbuda                    | <input checked="" type="checkbox"/> <b>GM</b> Gambia .....                                    | <input checked="" type="checkbox"/> <b>NO</b> Norway                                 |
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| <input checked="" type="checkbox"/> <b>BZ</b> Belize .....                           | <input checked="" type="checkbox"/> <b>KR</b> Republic of Korea .....                         | <input checked="" type="checkbox"/> <b>SE</b> Sweden                                 |
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| <input checked="" type="checkbox"/> <b>CH &amp; LI</b> Switzerland and Liechtenstein | <input checked="" type="checkbox"/> <b>SL</b> Sierra Leone .....                              | <input checked="" type="checkbox"/> <b>SK</b> (and utility model)                    |
| <input checked="" type="checkbox"/> <b>CN</b> China .....                            | <input checked="" type="checkbox"/> <b>KZ</b> Kazakhstan .....                                | <input checked="" type="checkbox"/> <b>SY</b> Syrian Arab Republic                   |
| <input checked="" type="checkbox"/> <b>CO</b> Colombia .....                         | <input checked="" type="checkbox"/> <b>LC</b> Saint Lucia .....                               | <input checked="" type="checkbox"/> <b>TJ</b> Tajikistan .....                       |
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| <input checked="" type="checkbox"/> <b>CU</b> Cuba .....                             | <input checked="" type="checkbox"/> <b>LR</b> Liberia .....                                   | <input checked="" type="checkbox"/> <b>TN</b> Tunisia                                |
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| <input checked="" type="checkbox"/> <b>DE</b> Germany .....                          | <input checked="" type="checkbox"/> <b>LT</b> Lithuania .....                                 | <input checked="" type="checkbox"/> <b>TT</b> Trinidad and Tobago                    |
| <input checked="" type="checkbox"/> <b>DK</b> Denmark .....                          | <input checked="" type="checkbox"/> <b>LU</b> Luxembourg .....                                | <input checked="" type="checkbox"/> <b>TZ</b> United Republic of Tanzania            |
| <input checked="" type="checkbox"/> <b>DM</b> Dominica .....                         | <input checked="" type="checkbox"/> <b>LV</b> Latvia .....                                    | <input checked="" type="checkbox"/> <b>UA</b> Ukraine .....                          |
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| <input checked="" type="checkbox"/> <b>EC</b> Ecuador .....                          | <input checked="" type="checkbox"/> <b>MD</b> Republic of Moldova .....                       | <input checked="" type="checkbox"/> <b>US</b> United States of America .....         |
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| <input checked="" type="checkbox"/> <b>GB</b> United Kingdom                         | <input checked="" type="checkbox"/> <b>MW</b> Malawi .....                                    | <input checked="" type="checkbox"/> <b>CS</b> Serbia and Montenegro                  |
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| <input checked="" type="checkbox"/> <b>GE</b> Georgia .....                          | <input checked="" type="checkbox"/> <b>MZ</b> Mozambique .....                                | <input checked="" type="checkbox"/> <b>ZM</b> Zambia .....                           |
|  |   | <input checked="" type="checkbox"/> <b>ZW</b> Zimbabwe .....                         |

Check-boxes below reserved for designating States which have become party to the PCT after issuance of this sheet:

☐ ..... ☐ ..... ☐ .....

**Precautionary Designation Statement:** In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time limit.)